Incorporating Mortality Reductions from Use of Low-Cost Power into Evaluations of Externality Proposals

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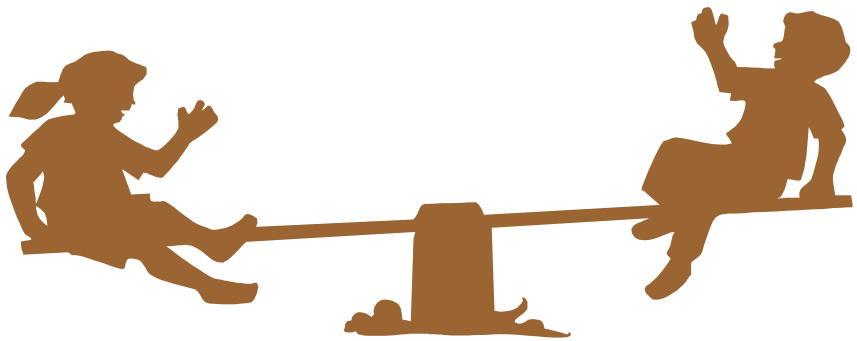
This Presentation is about Trade-offs

Prudent reductions in harmful emissions can lead to improved health protection

However, the economic costs of these regulations can *increase* risks to individuals, and hence shorten lifetimes



Key Issue: Do these opposing forces create net *benefits* or net *losses*?

- We develop a framework to examine this issue, focusing on coal use for electricity generation
- We estimate the cost-induced risks, to be used with outside estimates of emission reduction benefits

Groundwork Developed in Early 1990s

Research efforts in 2 different areas:

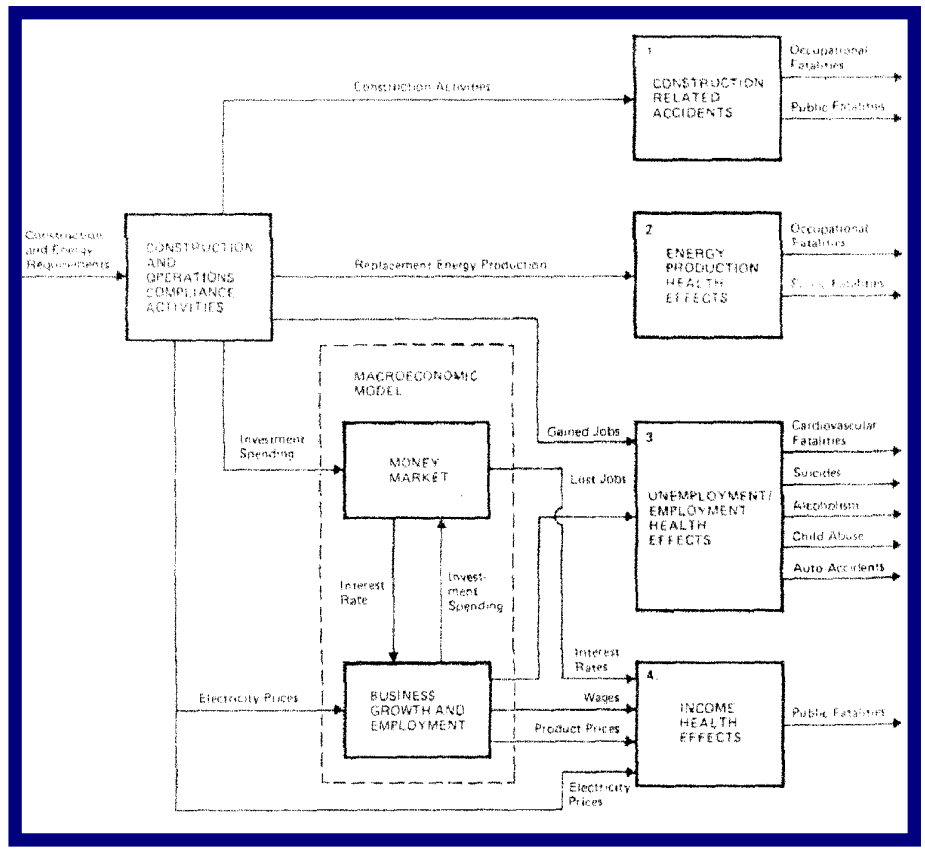
1. Utility Externalities
   - ❖ Monetizing unregulated an/or residual emissions
   - ❖ State regulatory activities
   - ❖ ORNL studies
2. "Wealthier is Healthier" analyses
   - ❖ Explored adverse effects of lower income
   - ❖ Begun by Wildavski (1980)
   - ❖ Key contributions by Viscusi, Keeney, and others

Two Concepts Linked in 1994

- Kathan and Klein: *Full Consideration of Externalities*
- Raised the question: Can the *costs* of incorporating externalities have a *negative* effect on health and mortality?
- Initial work sponsored by DOE-FE (Tom Grahame)
- Presented at NARUC-DOE Fifth National Integrated Resource Planning Conference (Kalispell, MT, May 1994)

Many Indirect Health Effects of Powerplant Environmental Compliance

- Macro effects from higher costs
- Macro effects from employment changes
- Construction of replacement power facilities
- Development of natural gas and other fuel sources
- Fuel transportation risks and emissions
- ….and many others, both + and −



(from Keeney and von Winterfeldt, 1986)

Analytic Framework Refined in 2002

- Klein and Keeney: *Mortality Reductions from Use of Low-Cost Coal-Fueled Power: An Analytical Framework*
- Examines some of the mortality impacts when electric power costs rise
- A Peer-Reviewed study:
  - ***James K. Hammitt*** (Harvard School of Public Health)
  - ***Detlof von Winterfeldt*** (University of Southern California)

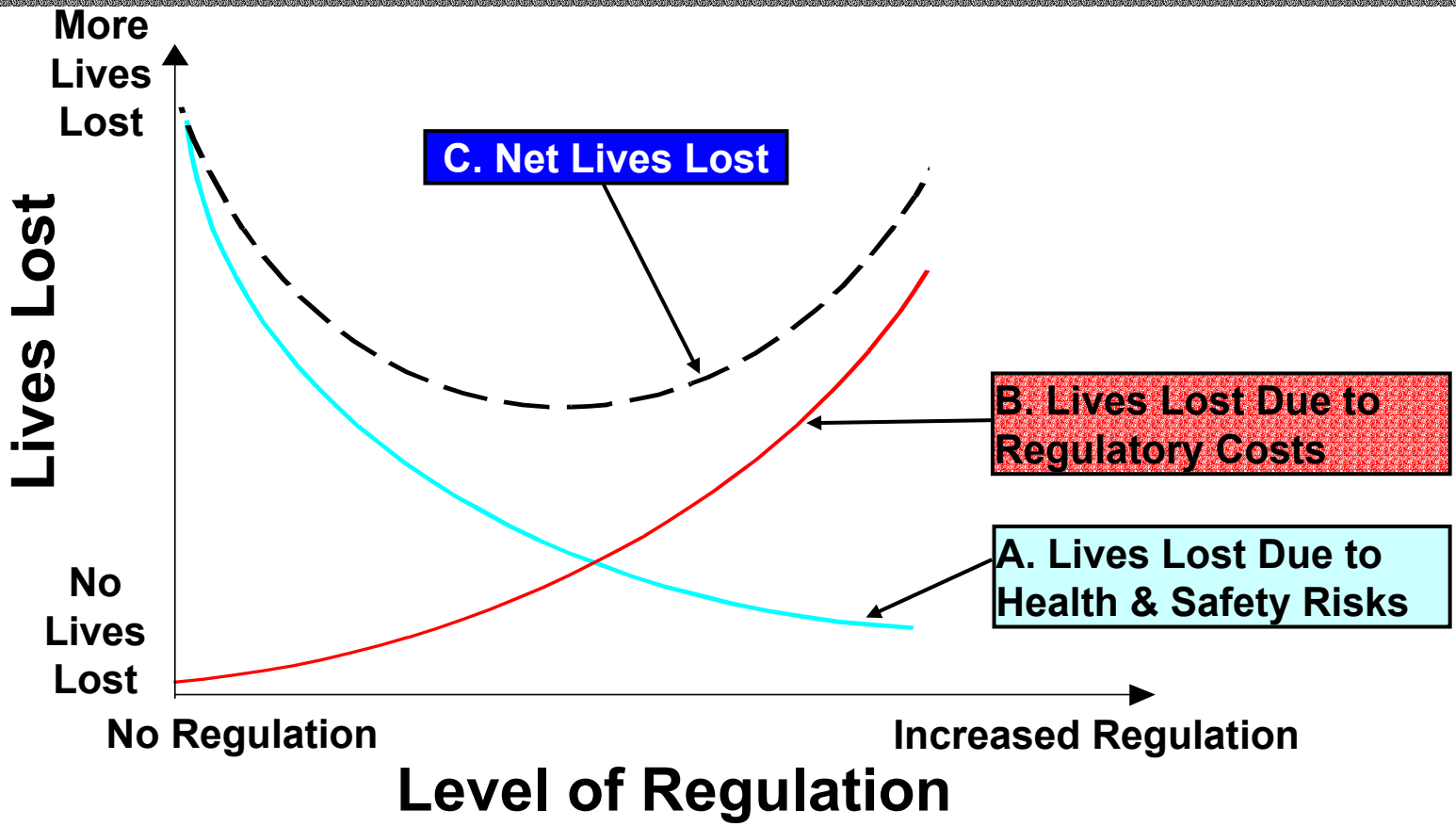
Higher Income ⟹ Safer & Healthier

- Well documented that wealthier countries tend to have longer life spans
- Within countries, wealthier individuals tend to live longer than poorer ones
- Linkage is widely noted and embraced:
  - World Bank
  - World Health Organization
  - World Resources Institute
  - …. and many others
- Government policies increasingly focus on reducing human health and safety risks

Can Reducing Health and Safety Risks Also Create Health and Safety Risks?

- Most regulatory programs cost money
- Program costs reduce disposable income available for other purposes
- Fewer resources available for other health and safety measures, esp. among the lower-income households
- Hence, regulatory *costs* can impact mortality
  - Deaths due to less disposable income
  - Deaths due to higher unemployment

Regulatory Costs Can Create Difficult Tradeoffs



On Net, Greater Regulation May Not Always Save Lives

- Not simply a benefit-cost issue of "people vs. profits "
- It's a weighing of *relative* risks
  - Health and safety improvements due to regulation …
  - … versus health and safety losses due to the regulatory cost
- Logical and moral comparison is one of "people saved versus people lost"
  - "health-health" or "risk-risk" analysis

Three Primary Categories of Mortality Impacts

1. Adult mortalities induced by regulatory costs
2. Child mortalities induced by regulatory costs
3. Mortalities induced by higher unemployment

- This analysis focuses on #1: adult mortalities induced by regulatory costs.
- Other categories were reviewed but not rigorously quantified.

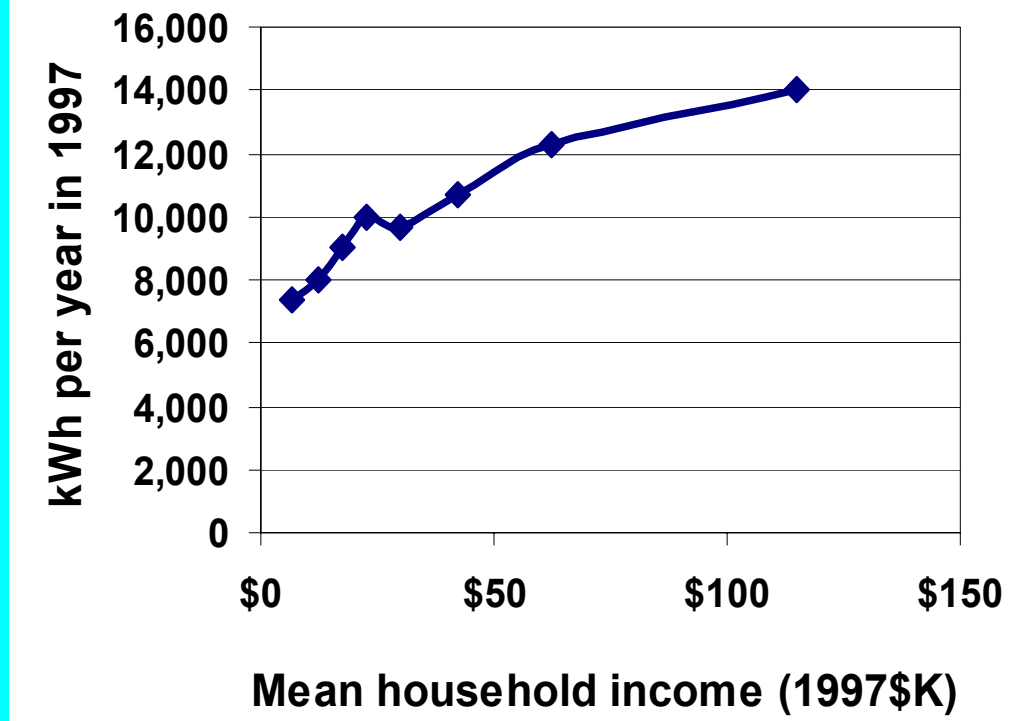
Methodology to Estimate Adult Deaths Induced by Regulatory Costs

1. Distribute costs by household income range – use $1 billion "unit cost"
2. Determine relationship between reduced income and mortality
3. Tabulate the mortality effects
   - Lives per $ billion
   - $ per induced death
4. Apply $ per induced death to total cost of regulatory issue at hand

Three Methods to Distribute Costs Across Household Income Ranges

1. *Low end:* Proportional to income
2. *Best estimate:* proportional to electricity use
3. *High end:* Equal $ per household

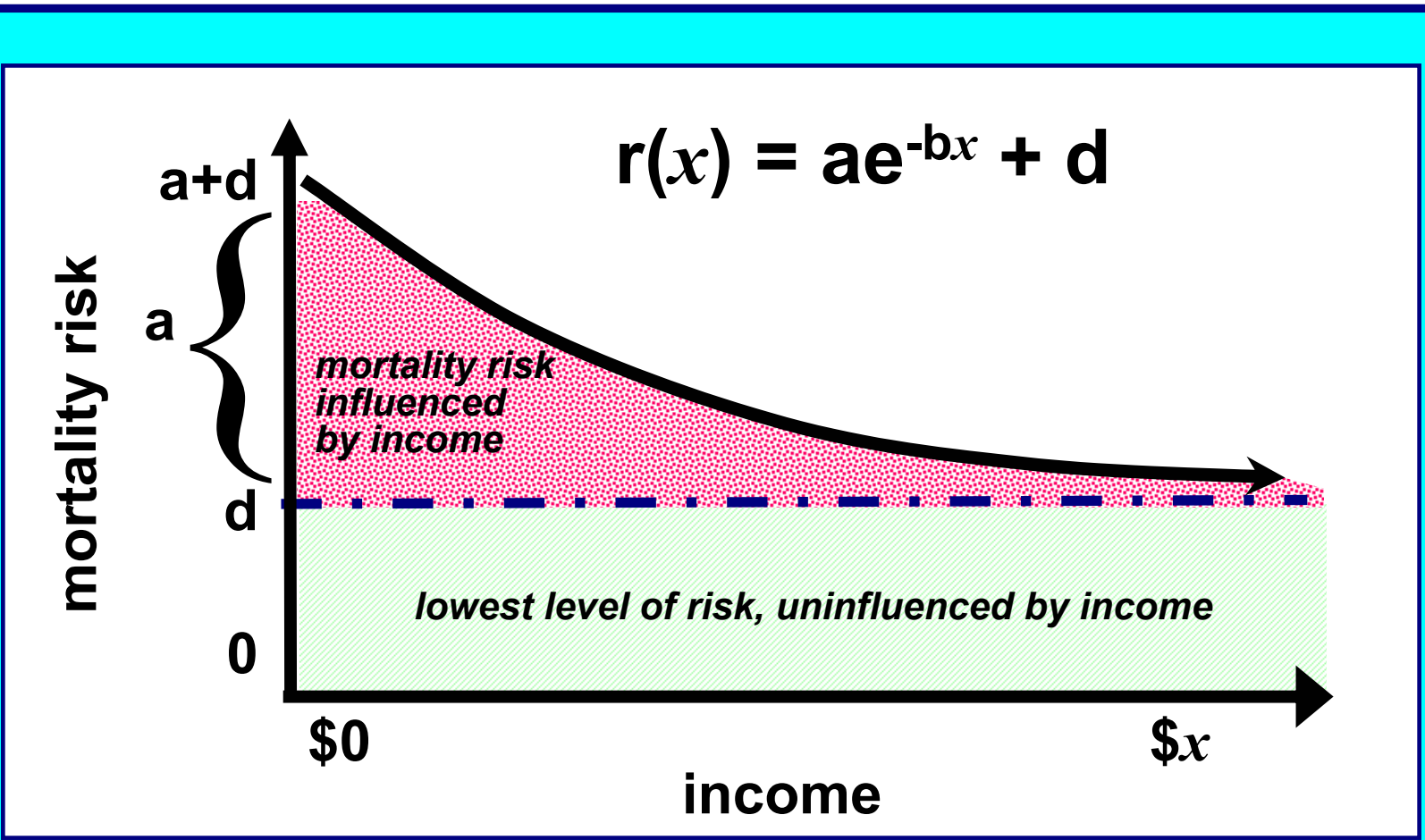
Relationship between Household Income and Electricity Use in 1997



Annual Cost per Household of a $1 Billion Regulation in the U.S.

Income range (1999$)	Relative regulatory costs: Costs proportional to income	Relative regulatory costs: Costs proportional to electricity use	Relative regulatory costs: Equal costs per household
Under $10,000	$0.87	$6.31	$9.55
$10,000 - $14,999	$2.18	$6.79	$9.55
$15,000 - $24,999	$3.48	$7.28	$9.55
$25,000 - $34,999	$5.22	$7.93	$9.55
$35,000 - $49,999	$7.40	$8.75	$9.55
$50,000 - $74,999	$10.88	$10.05	$9.55
$75,000 and over	$22.14	$14.26	$9.55

Mortality Risk Increases for Lower Income Levels



Estimated Adult Deaths Induced per $1 Billion of Regulatory Costs

	Relative cost allocation		
	Proportional to income	Proportional to electricity use	Equal per household
$Millions per death:	$18.5	$8.9	$6.8
Total Adult Deaths: per $1 billion	54	112	147

Summary of Coal Impact Analyses

(Adjusted to 100% Coal Replacement, 2000$)

Source	Scenario	Change in 2010 Disposable income ($billions)	Change in 2010 Employment (millions)
DRI (1998)	Case 1: 77% of U.S. CO2 reductions	($454)	(3.7)
EIA SR 98-03 (1998)	Reference Case vs. 1990 Level Scenario	($225)	(2.2)
EIA SR 2001-03 (2001)	Integrated NOx, SO2, CO2 1990-7%, Hg (no RPS)	($215)	(2.5)
Rose and Yang (2002)	High Price Gas Case (average of 4 scenarios)	($170)	(4.5)
Rose and Yang (2002)	Low Price Gas Case (average of 4 scenarios)	($127)	(3.4)
WEFA (1997)	Carbon Stabilization	($159)	(2.6)

Estimated Adult Deaths Induced by Costs of Forgoing Coal

	Relative cost allocation		
	Proportional to income	Proportional to electricity use	Equal per household
$Millions per death:	$18.5	$8.9	$6.8
Total Adult Deaths:			
per $1 billion	54	112	147
$125 billion	7,000	14,000	18,000
$225 billion	12,000	25,000	33,000

Induced Deaths Fall Disproportionately on Lower-Income Households

Income range (1999$)	Households: Percent in Income Range	Households: Cumulative Percent	Deaths: Percent in Income Range	Deaths: Cumulative Percent
Under $10,000	9.2%	9.2%	27.2%	27.2%
$10,000 - $14,999	7.3%	16.5%	15.9%	43.1%
$15,000 - $24,999	14.1%	30.6%	23.1%	66.2%
$25,000 - $34,999	12.7%	43.3%	14.5%	80.7%
$35,000 - $49,999	15.8%	59.1%	11.6%	92.3%
$50,000 - $74,999	18.4%	77.5%	6.7%	99.1%
$75,000 and over	22.5%	100.0%	0.9%	100.0%
	100.0%		100.0%	

Potential Areas of Future Analysis

- Goal: A fuller accounting of lives saved and lives lost
- Broadening the Analysis
  - Child mortality data
  - Unemployment effects

  } ***Other studies suggest substantial mortality impacts, possibly > 100,000 lives***

  - Time period over which income and employment impacts persist
- Deepening the Analysis
  - Use more current data on mortality (U.S. & other countries)
  - Refine and strengthen connections between residential electricity use and cost impacts